

appears exceedingly small compared with the price of magnesian limestone at other quarries. If the Auston quarry price does not exceed that at Bolsover Moor, the stone can be delivered at less than 2s. per foot in London, as the circumstances of transport are much more favourable.

No. 157 contained a specimen of magnesian limestone from Mansfield Woodhouse quarries very much resembling the specimens before described. It also contains specimens of red and white sandstone quarried respectively at Lindley's Red and White Quarries, Mansfield. Both these quarries were particularly examined by the Royal Commission in 1839, and the stone resisted tolerably well the tests applied. The price of the stone is moderate at the quarries, each being about 8d. per foot, while the red stone would cost about 2s. 6d. per foot in London, and the white about 2s. 2d. The white appears to have stood the tests better than the red, showing only about half the amount of disintegration, absorbing less water, and requiring greater weights to crush and to produce fracture. It contains rather more silica than the red, more carbonate of magnesia, and less iron alumina. The red stone weighs 148 lbs. 10 oz., and was used in the construction of Belton House, the mansion of Lord Brownlow, near Grantham. The white stone is somewhat heavier, and was also used at Belton House, as well as in the Town Hall of Mansfield, Clumber Lodge, and Wollerton. The demand for magnesian limestone has lately been so great that the quarries of Mansfield Woodhouse have lately been re-opened after a lapse of some centuries, to supply stone for the new Houses of Parliament and other buildings.

No. 196 comprised specimens from the neighbourhood of Liverpool, also from Runcorn, Stourton, and other places in Cheshire. The varieties from Liverpool are a dun-coloured sandstone, with quartzose grains, coloured by peroxide of iron, from Brunswick-road, and a nearly similar block from Toxteth-park. These stones are locally used for building purposes. A yellow sandstone from Hardman-street, Liverpool. A light dun-coloured fine-grained sandstone from Runcorn; a yellowish cream-coloured sandstone from Runcorn. A similar stone from Flaybrigg-hill, Cheshire; a yellowish strong-grained sandstone from Bidston-hill, Cheshire; and a light cream-coloured grit from the quarries of Sir Massey Stanley, at Stourton, Cheshire. All the above are quartzose, with little or no mica. The Stourton stone is a remarkably clear-grained variety, and leads one to suppose that the grains of quartz had been well washed and cleaned before being deposited. At the same time the cement is strong and crystalline, so that the stone, besides having a very beautiful appearance in a building, is at the same time exceedingly durable. The stones exhibited under this number are specimens of those used for building purposes in Liverpool.

As the magnesian limestone occurs in the form of a conglomerate in the Bristol coal, there were many specimens of it from Chew Magna, New-cut, Bristol, St. John's Church, Clifton, Clevedon, Harptree, Hung Road, Cheddar, Markham Bottom, the Mendip Hills, &c. One or two of these are the ordinary dun-coloured new red sandstone, but the greater part of them are conglomerates of limestone and old red sandstone fragments imbedded in a magnesian-calcareous cement. The sections made by polishing are in some specimens very beautiful, but the polish is chiefly where the limestone fragments are cut through. Where the section passes through the sandstone the surface is quite earthy and gritty, nor does the surface of the cement take any polish. We are not aware that these conglomerates have ever been applied to any useful purposes, although some of the varieties are very ornamental.

LIAS LIMESTONES.

It will be unnecessary to describe the range of the lias formation in this country, as it follows almost everywhere the course of the new red sandstone resting on it, filling up the valleys of the new red sandstone, and forming with its harder and upper beds of lias

marlstone the first step or terrace of the oolitic range of hills which form so prominent a feature in all the English counties from Dorsetshire to the eastern moorlands of Yorkshire. The lias formation usually contains in its upper division argillaceous and alum shales, succeeded by calcareous and ferruginous sandstones, and this again by argillaceous carbonates of lime, alternating with softer beds of marl and marlstone. Although it contains some important mineral ingredients, as alum, iron ore, and septaria, which is burnt into Roman cement, the building stones which it supplies are not of great extent or value, and the specimens contained in the Exhibition are chiefly from the south-west of England. The white lias furnishes occasionally an ornamental variety of building-stone, and many of the bluish argillaceous beds are quarried and used locally for ordinary building purposes. Some of the beds, which are of a shaly or slaty structure, are used for steps and flooring, also for paving and stone seats. Some of the crystalline varieties which contain vegetable impressions like the dentritical lias of Cotham, near Bristol, have been polished and used for chimney-pieces, but are now generally superseded by more ornamental marbles, while perhaps the most important use made of the argillo-calcareous beds is that of burning them into hydraulic lime, which is highly valued for submarine works, from its valuable property of hardening under water.

There were specimens of lias building-stone of a greyish blue colour from Lyme Regis (No. 193), from Curry Rivell, near Langport, and from Ilminster; also lias paving-stone from Keinton, Somersetshire, and from Long Sutton, near Langport, which last is said to be very durable. Besides these there were specimens of the white lias from Beer Crowcombe, and from Weston, near Bath, both of which are a very light cream colour, take a good polish, and would probably stand well for interior work. The Beer Crowcombe stone was examined by the Royal Commissioners in 1839, and reported as friable with only partial induration. Blocks may be procured 6 to 7 feet long and 2 feet thick, said to have been used in the neighbouring churches, in Saint Peter's Church, Exeter, in exposed parts, in Colyton Church, Charmouth and Honiton Churches. Weight 131 lbs. 12 oz. per cubic foot.

There was a specimen from Keynsham (No. 29), being a blue lias used for making hydraulic lime, and weighing 169½ lbs. per cubic foot; also two specimens of white lias from Paulton and Radstock, in Somersetshire, each weighing about 132 lbs. and taking a very smooth and beautiful surface when polished. The same collection contained a specimen of landscape lias from Cotham, near Bristol, which spot being now covered with buildings will scarcely be worked in future.

BUILDING STONES OF THE OOLITES.

The oolitic range is one of great extent in this country, and consists of two principal masses; one of them occupying the district called the Eastern Moorlands of Yorkshire, and the high grounds adjacent, called the Hambleton and the Howardian Hills. The other mass is a long diagonal range of hills extending from the Humber through the counties of Lincoln, Leicester, Rutland, Northampton, Buckingham, Oxford, Gloucester, Wilts, Somerset, and Dorset, to the coast at Weymouth.

The composition of the oolitic rocks varies very much; and those of Yorkshire in particular are characterised in a very remarkable manner, which it will be unnecessary to notice here, as there are no specimens in the Exhibition from that part of the oolitic series. In fact, with the exception of specimens from Ancaster and the neighbourhood of Stamford, all the oolitic stones exhibited are from the great and lower oolites of Somersetshire, and the other western counties. The great oolite consists usually of a stratified mass of calcareous beds varying from 130 to more than 300 feet in thickness, most of them, and especially the central bed, possessing that oviform structure which arises from the aggregation of small round grains about the size of mustard

seeds. These grains are frequently small organic bodies coated with carbonate of lime, and united to each other by a calcareous cement. The beds have very thin partings of clay, and besides the principal thick indurated deposit termed the great oolite, there are other calcareous and calcareo-arenaceous beds termed Cornbroth, Forest marble, &c., alternating with thick beds of clay. The colour of the best beds, which are called freestones and worked for building purposes, is generally whitish, with a shade of yellow or straw-colour. The inferior oolite in the neighbourhood of Bath, where it is, perhaps, better developed than in any other part of England, is separated from the great oolite by a mass of clay and fuller's earth about 140 feet in thickness, to which succeed beds of freestone about 30 feet thick, forming the inferior oolite, and generally being of good quality for building purposes. During the middle ages, when our architects were chiefly ecclesiastics, and before the introduction of Portland stone, those of the oolite formation shared with the freestones of Surrey the principal amount of favour. It is probable that attention was first directed from the beautiful oolites of Normandy, so well known in most of our old ecclesiastical buildings, to stones of a similar kind in our country capable of being sawn and carved into every variety of form. Hence the Bath quarries were called into requisition, and continued in favour till Sir Christopher Wren, in building St. Paul's Cathedral, introduced the Portland stone, which for some centuries enjoyed a decided pre-eminence. It seems now to be generally admitted that, with the exception of a very few beds, the oolites, although admirable for interiors and for carved work of every description where protected from the weather, are not well adapted for building exterior walls in this country, though the question of cost still enforces their use. The exceptions are perhaps the beds of the lower or inferior oolite, which are of a better kind; and some beds from the middle oolite near Bath. It has been usual in applying a popular designation to term many different varieties of oolite, indiscriminately, *Bath stone*,—a designation by which the real Bath stone has seriously suffered. For instance, the colleges and halls of Oxford, which are well known to be in a most deplorable state of dilapidation, from the decay of the stone, are frequently said to have been built of Bath stone, whereas they are built of Headington stone, a member of the upper oolite of a very inferior description. We have not noticed the upper oolite beds at all, as we are not aware that they furnish any stone of real value for building purposes, although some of them—particularly the blue beds—burn into excellent lime. The selection of Bath stone requires very great care, as the variety in the different beds is very remarkable. The beds should be carefully tested, and a comparison made of their strength to resist disintegration; and it will also be found an excellent method to leave the blocks, after being quarried, a full winter in the quarry, in order that natural frosts may be experienced, and that the quarry-water, or natural moisture of the stone, may evaporate before the stone is placed in the building. Inferior stone, so treated, will frequently split in two, and shiver to a greater or less extent during the first winter, showing its unsuitability for a building stone. We contemplate making a personal examination and report on the Bath stones one of these days.

No. 179 contained a specimen of stone from the great oolite of Ancaster, in Lincolnshire. This is a light cream-coloured stone, remarkable for the fineness of its grain, and for the sharp arris it will carry when dressed. It contains 93 per cent. of carbonate of lime, and by disintegration of frost, loses one grain in 655; weight, 139 lbs. 4 oz. per cubic foot. Used in Woollaton Hall, Belvoir Castle, Belton House, and numerous churches and mansions in Lincolnshire. Price at quarry in random blocks, said to be 9d. per foot. Price in London, including land carriage of seven miles, 2s. 7d. per foot: price of dressing the face about half that of Portland stone. It is probable the price in London will be much reduced on the completion of the